

XXX.—*Remarks on the Stomach-contents of Birds.*

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ON reading the conclusion of Mr. G. L. Bates's extremely interesting account of the Birds of Southern Cameroons (Ibis, 1911, p. 630), I was much struck by the fact that his results, from a not over-minute examination of stomach-contents of birds, much resembled mine up to December, 1908. Out of more than a thousand stomachs of which I had then noted the insect-contents, I had recognised remains of butterflies in only five. And the instances in which I had actually witnessed an attack of birds on butterflies were hardly more numerous.

This is evidence that might, not unreasonably, have been held to justify the belief that the birds of Northern Gazaland probably "do not feed to any great extent on butterflies." Yet when, urged by my friend Mr. G. A. K. Marshall, I lately set to work by special observation and experiment to really get to the bottom of what takes place in this locality, I obtained, within three years, records of several hundred attacks: a total reversal of previous results that seems to suggest that negative evidence drawn from a not over-minute examination of stomach-contents should not be too implicitly relied upon. It may be of interest to go into some of the probable reasons for this.

1. *Removal of wings; rejection of head; piecemeal eating.*

It is a fact that, at Chirinda, birds appear usually to swallow their smallest butterflies whole; that very many (*e. g.* most of the Picariæ that I have observed) do the same for even the largest; and that some of those that do dis-wing them often do so more or less incompletely; also that the head of an unpleasant species may, very occasionally, be swallowed and the rest rejected.

On the other hand, the wings *are* very often removed, some birds habitually going to very great trouble in this connexion; the head has on many occasions, in my observations, been rejected; and there are many birds that eat their larger

butterflies piecemeal. The latter process is likely to be particularly effective in quickly disguising the identity of an insect with so weak a chitinous covering. In the case of the only two Ploceids on which I have experimented, the butterfly was commonly reduced by fine nibbling to a flat and almost unrecognisable pulp even before it was swallowed.

2. Some, probably most, insectivorous birds digest with great rapidity, and they get rid of the chitin they have swallowed in two ways: (1) crushed small, in the excreta; and (2) in the form of pellets that are brought up at longer intervals. It had been suggested to me by the examination of the pellets and excreta respectively of several species, that the wings of some of the insect-orders and the weaker chitin generally are probably, as a rule, more rapidly and thoroughly disintegrated than the harder portions, and that much of the former may already be passing out through the intestines and so lost to the stomach-examiner at a time when the more obstinate fragments of the same meal are still awaiting, in the stomach, their expulsion with the next pellet; and, so far as they went, a few special experiments on specimens of *Lanius*, *Laniarius*, and *Dicurus* quite confirmed this view.

3. In these experiments the wings of butterflies appeared for the most part, both in the pellets and the excreta, as narrow, oblong, transparent strips varying from roughly half a millimetre to one and a half in length by, frequently, only the distance between the rows of scale-bearing "collars." They were readily recognisable only under the microscope. This thoroughness of disintegration, if it represents what usually takes place, must be highly destructive to evidence, and should be given full consideration. After large butterfly-feeds of some of my captive birds I have often (though not invariably) felt, in examining a pellet composed almost solely of butterfly débris, that had I found that mass in a bird's stomach and subjected it merely to the usual rough examination, my verdict might well have been "Fine insect-débris, unrecognisable." The special experiments that I have referred to have afforded further excellent examples:

even where butterflies had preponderated, there was often quite a difficulty in detecting their presence in the ensuing pellets, yet no difficulty whatsoever occurred over the hard-chitined beetles and grasshoppers eaten along with them. There was an indication in one case that such tough, pliable wings as those of the *Danaïdæ* may form a partial exception to the rule.

These considerations should, of course, be quite as applicable to other comparatively fragile-bodied insects, arachnids, &c., as to butterflies; and it seems to me somewhat unlikely that many insects of this kind will continue to be readily recognisable for long after having been swallowed; in other words, that the majority of those we do readily recognise are probably recent captures. Even the occasional ability to recognise large numbers of Diptera—as such—in a single stomach does not necessarily tell against this view, when we remember the enormous numbers in which these insects are often present and the rapidity with which, therefore, the stomach may have been filled with them after the ejection of a pellet.

How comes it then, if butterflies are not, as a class, disliked, that they appear to have been less frequently found in birds' stomachs than equally (or more) weak-chitined insects of certain other Orders or than spiders?

Possible Reason 4. My observations and experiments support the view that certain species of birds have become specialized to prey on certain abundant orders, particularly at Chirinda on Diptera, and probably, in the case of Sunbirds, on spiders.

In such cases it seems not unlikely that, so long as the object of their special affections is present continuously and in great abundance (and only so long), the particular birds in question will seldom quite find "room inside" for even the pleasanter species, not only of butterflies, but, equally, of the other Orders outside their favourite domain; and that, if shot at such times, members of these Orders will rarely be found in their stomachs.

Nevertheless, and this should be particularly noted, I have

witnessed a good many attacks on butterflies by several such apparent "specialists" at times when their specialty happened to be present in less abundance.

5. Were I to say that during the past year, the first during which I have paid special attention to this particular point, small Diptera, excluding house-flies, have been on the average five hundred times as numerous on Mount Chirinda as butterflies, I should, I firmly believe, be guilty of a very considerable understatement of what has actually been the case. But, to be well on the safe side, I will place it at that figure. The law of probabilities, then, would lead us to expect that for every butterfly found by a collector during the past year in the stomachs of our local birds, he ought, other things being equal, to have found five hundred Diptera. This argument might well be extended to embrace some of the harder Orders. Thus grasshoppers are here several times more numerous than butterflies all the year round. The same may be said of beetles during at least a few months of the year. And Hymenoptera, including as they do both ants and honey-bees, are vastly more numerous here than the diurnal Lepidoptera.

6. Although I did not use Diptera in the special experiments I have referred to, I have on several other occasions taken their wings whole and undamaged from pellets and excreta in which the wings of Lepidoptera had been reduced to the minutely fragmentary condition described above.

7. I have noted the pellet-habit on the part, I believe, of every carnivorous or purely insectivorous bird that I have kept in captivity: Owls, Hawks, Passerines, large and small, and Picarions. More or less frequent in any case, it seems to come into play most when food is so continuously abundant that, if the bird is to use that abundance to the very best advantage, the intestines must be specially aided to get rid of the masses of chitin by which it is so commonly accompanied. It seems likely, therefore, that where in nature the food-supply is both abundant and comparatively uninterrupted, it may be no unusual thing for several pellets to be

brought up in the course of a single day ; so that, even were *all* chitin held over for evacuation by mouth, the examiner of a bird's stomach could expect to find there at a given moment indications of the food eaten during only a comparatively short time previously. Even the most minute examination of a merely moderate number of stomachs of a given species cannot, therefore, be held to have necessarily thrown full light on its feeding habits.

I need not, I think, enter into the question, "Why have more actual attacks on butterflies not been witnessed"? In the first place, it is outside the scope of this note ; in the second, Mr. G. A. K. Marshall's splendid collection of records (Trans. Ent. Soc. 1909, p. 329) tends to shew that many more have been witnessed and recorded than seems to have been commonly supposed ; and, thirdly, Dr. Trimen's suggestion (Proc. Ent. Soc. 1897, p. 89), "the neglect of well-directed and sustained observation," doubtless accounts for much. But (for reasons already stated under No. 5 above), I should, in any case, so far as *Chirinda* is concerned, be extremely surprised to see as many or, under ordinary circumstances, anything like as many attacks on butterflies as on insects of other Orders.

To sum up the actual subject of this note, my recent work has convinced me that conclusions based on stomach-examination are likely to be fallacious, unless that examination has been so thorough and minute that even such small objects as the scales of Lepidoptera must have been detected if present even in small numbers, in either stomach *or* intestines, unless a very large series has been so examined for each species, and unless, finally, a note had been made at the time of the shooting of each specimen as to the probable proportions in which insects of various kinds were present at the moment. The re-examination is also suggested of all such stomach-contents, still available, as have not been already thus exhaustively investigated, special attention being paid to the dust and finer débris. The difficulty of distinguishing between moth and butterfly débris will always be present, yet even here something may perhaps

be done. Thus out of twenty small excreta picked up at random in the Chiriinda Forest and containing various remains, eighteen (a proportion that astounded me) proved to contain the scales and small wing-fragments of Lepidoptera, and in several cases these were indistinguishable under the microscope from those of *Mycalesis campina*, a butterfly that was present at the moment in considerable numbers. The examination of large numbers of excreta, particularly when, as at the nest, the bird can be identified, appears to me as likely to be a somewhat useful line of research.

XXXI.—THE PROGRESS AND CONDITION OF THE
UNITED STATES NATIONAL MUSEUM AT WASHINGTON.*

THE final accession of birds in 1910-11 from the Smithsonian African Expedition comprised 1,379 dried skins and 213 alcoholic specimens, skeletons, and eggs, and supplied many desiderata, of which the most important was the Shoebill, *Balaniceps rex*, a form not hitherto represented in any American museum. It also contained examples of other genera new to the collection, including *Anastomus*, *Dicrocerus*, *Macrodipteryx*, *Scotornis*, *Cryptorhina*, *Sorella*, and *Elminia*, and of numerous species and subspecies now first obtained from this source. Ninety skins of Chinese birds were received from the Museum of Comparative Zoology in exchange; and 83 skins from Luzon, Philippine Islands, were presented by Dr. H. C. Curl, United States Navy. The last consignment from the Java Expedition of Mr. Owen Bryant, consisting of skins, nests, and eggs, contained several examples of the interesting Weaver-birds (Ploceidæ). Skins of North and Central American species to the number of 1,210, among which are many well-prepared specimens

* Extracted from the "Report and Condition of the U.S. National Museum for the year ending June 30, 1911." Washington: Government Printing Office. 1911.